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CAUSAL ANALYSIS OF A MIGRATION OF THE SNOUT BUTTERFLY, *LIBYTHEANA BACHMANII LARVATA* (STRECKER) (LIBYTHEIDAE)

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ABSTRACT. Observation of a massive migration of the snout butterfly, *Libytheana bachmanii larvata* (Strecker), in central Texas in 1971 is described. An association of peak migration periods and periodic precipitation episodes is believed to be causal in nature.

One of the many migratory species of Lepidoptera is the snout butterfly, *Libytheana bachmanii larvata* (Strecker). At irregular intervals great numbers of this species migrate in various directions in south and central Texas. The latest of these large migrations occurred during July–September 1971. One previous report exists for this migration (Helfert, 1972) in which only a portion of the migration is discussed. Helfert initiates his remarks with observations on 22 August 1971 and concludes them on 2 September. Migratory activity was at a peak during this period but occurred both before and after this time.

The purpose of this communication is to supplement the data available on this particular migration and to discuss possible environmental triggers involved in this phenomenon. A hypothetical relationship between snout butterfly population recruitment and periods of substantial rainfall is presented. Personal observations of the 1971 flight will be presented chronologically before analysis.

In order to critically analyze a mass migration of snout butterflies as the one observed in 1971, one must be aware of normal conditions. In central Texas, i.e., the Austin area, snout butterflies are present in low numbers, with adults being active on warm winter days (H. G. Lacey *in* Kendall & Kendall, 1971). Despite its constant presence, snouts are not apparent to non-lepidopterists, particularly those living in urban areas. In south Texas (area south of San Antonio) snout butterflies are often abundant (though highly scattered spatially and temporally) and quite regularly migrate in large numbers.

Butterflies of the genus *Libytheana* are variable in phenotype; species relationships are still unclear. The populations of central and southern Texas are referred to *Libytheana bachmanii larvata* (Strecker). Howe (1975) indicated that the taxon of the snout butterflies in the Kansas flight (see discussion below) was *Libytheana carinenta mexicana* Michener. This taxon rarely occurs in the United States. Clench (1968) was "not certain that this entity is really distinct from

L. bachmanii larvata (Strecker)." These forms, whatever their true relationship, have been taken flying together (Heitzman & Heitzman, 1972). However, W. D. Field (in litt., 11 May 1976) reports that specimens from the migration collected by Howe in Kansas are not *carinenta*. Examination of personal color transparencies taken during the 1971 migration in central Texas reveal that the taxon involved was *larvata*. Ferris (1976) reports that all snout butterflies figured in Howe (1975) are *larvata* and that the verbal descriptions of these two species are reversed.

1971 Observations

As early as 20 July 1971 snout butterflies were very common in Austin. Butterflies were moving individually (similar to migration of 22–25 August reported by Helfert). On 25 July snout butterflies were seen "by the thousands." Many were noted on leaflets of a chinaberry tree (Meliaceae: *Melia azedarach* L.) growing on the bank of Waller Creek on the campus of the University of Texas at Austin. Adults landed on leaflets and appeared to feed from the surface as they unrolled their probosces and moved them over the leaflet surface. On 26 July numerous adults were observed in similar feeding behavior on leaves and stem nodes of bean plants at the Brackenridge Field Laboratory (BFL) of University of Texas at Austin. Possibly nutrients and water (Austin area was still suffering from year-long drought) were obtained by these butterflies. Many snout butterflies were seen as late as 28 July, after which time numbers of snout butterflies declined.

A number of mature larvae of *larvata* were observed at BFL as early as 18 August on Texas sugarberry (Ulmaceae: *Celtis laevigata* Willd.) (see Neck, 1976). On 23 August adults were again noted as abundant (Helfert reports 22–25 August). At this point butterflies were traveling individually (as reported by Helfert) and were most abundantly found feeding at flowers of kidneywood (Leguminosae: *Eysenhardtia texana* Scheele).

An incredibly dense concentration of migrating snout butterflies moving NNE peaked on 27 August. Densities over central urban areas were not as high as observed outlying urban or rural areas. Peak numbers dropped off after 30 August. Helfert reports peak on 26–28 August with last large numbers seen on 2 September. Helfert records no further observations after 2 September, but my notes record "many, many snout butterflies" migrating together on 20 September after an intervening period of low abundance.

Indications are that this flight of snout butterflies traveled north-

TABLE 1. Drought severity in Austin, Texas, 1970–1971.

	Recorded rainfall	Normal rainfall	Accumulated deficiency since November 1970
November 1970	T	2.12	2.12
December	0.11	2.53	4.54
January 1971	0.04	2.35	6.85
February	0.69	2.58	8.74
March	0.79	2.13	10.08
April	1.07	3.55	12.56
May	1.37	2.71	13.90
June	1.68	3.22	15.44
July	1.23	2.18	16.39
August	5.69	1.94	12.64
September	2.13	3.44	13.95
Total	14.80	28.75	—

ward at least to east central Kansas, as Howe (1975:258) reported that "hundreds" of snout butterflies appeared in Franklin County, Kansas, in September and early October 1971 still "flying in a due north-northeast (N22.5°E) direction." Franklin County is about 1100 km north of the Austin area at an approximate direction of N12°E. If one assumes that these were butterflies from the peak migration of late August–early September in central Texas, these butterflies traveled the distance in approximately thirty days for an average daily distance of about 35 km. Daylength at that season is decreasing but is about 12 h. Allowing for low flight activity during the cool crepuscular period, one can assume an 8 h flight day (Helfert, 1972), yielding 4.4 km/h. This speed is certainly exceeded by these butterflies, allowing for sufficient time for energy source location and utlization. Previous reports of speed of migrating snouts have varied from 7.2 to 24 km/h (Gable & Baker, 1922; Parman, 1926; Fletcher, 1926; Clench, 1965).

Associated Weather System and Biotic Responses

In summer 1971, central and southern areas of Texas were experiencing a drought which had begun in late 1970 (see Table 1). Plant growth and insect populations were greatly depressed. Substantial rains occurred in the Border Country (Fig. 1) as early as 1 June (Table 2). However, at this time the central Texas area was still suffering from drought conditions, although rain would soon begin. The entire July rainfall (1.23 inches vs. average 2.18) occurred on and after 24 July. The first six days of August brought 5.23 inches of rain (average for entire month is only 1.94 inches).

FIG. 1. Base map of Texas, showing localities discussed in text. Solid line is Balcones Escarpment Zone; arrow indicates general direction of snout butterfly migration; names refer to weather station locations.

Central Texas was transformed from drought to lush conditions in a very short period of time. Plants put on new growth (up to 1 m branch growth in *C. laevigata*); insect populations increased dramatically. Various bird species, whose nesting had been curtailed by the dry spring and early summer, responded with late nesting attempts (Webster, 1972). Impact of the 1971 drought and heavy rain conditions affected the population dynamics of various lizards (Clark, 1976; Martin, 1977), snakes (Clark, 1974; Clark & Fleet, 1976) and small mammals (Beasom & Moore, 1977).

Rainfall in Austin for the remainder of August totaled 0.45 inches, while September rainfall was sporadic and subnormal (2.13 inches vs. average 3.44). Therefore, plant growth occurred profusely for a brief

TABLE 2. Extensive rainfall (and associated cool temperatures) in central and south Texas in summer 1971 which broke drought of 1970–1971.

Station	Ave. temp.	Departure from normal	Precipitation	Departure from normal	Greatest daily rain total
		June 1971			
Central Texas					
Austin	83.7	+1.8	1.68	−1.54	1.40
San Antonio	83.6	+1.7	2.74	−0.21	1.07
Border Country					
Carrizo Springs	84.2	−0.5	13.52	+10.98	3.81
Del Rio	80.1	−4.3	4.87	+2.58	1.03
Eagle Pass	82.0	−3.8	14.71	+12.28	4.85
Encinal 3NW	83.2	−1.4	10.80	+8.42	4.00
		July 1971			
Central Texas					
Austin	85.9	+1.4	1.23	−0.95	0.94
San Antonio	85.9	+1.9	1.05	−1.04	1.03
Border Country					
Carrizo Springs	84.2	−2.4	0.17	−1.66	0.13
Del Rio	82.0	−4.2	0.45	−0.86	0.33
Eagle Pass	83.0	−4.6	0.32	−1.72	0.32
Encinal 3NW	83.8	−2.7	0.17	−1.40	0.17
		August 1971			
Central Texas					
Austin	81.2	−3.5	5.69	+3.75	1.72
San Antonio	81.2	−2.6	9.42	+7.06	2.38
Border Country					
Carrizo Springs	80.4	−6.1	12.46	+10.15	6.00
Del Rio	78.6	−7.2	6.10	+4.58	2.76
Eagle Pass	79.2	−8.1	7.16	+4.82	1.77
Encinal 3NW	79.8	−6.5	3.62	+1.72	0.95
		September 1971			
Central Texas					
Austin	79.3	+0.2	2.13	−1.31	0.74
San Antonio	80.1	−1.5	4.57	+1.08	1.86
Border Country					
Carrizo Springs	80.1	−1.4	—	—	1.21
Del Rio	78.5	−1.4	0.50	−2.11	0.25
Eagle Pass	78.6	−2.8	1.19	−1.31	0.31
Encinal 3NW	77.4	−3.9	9.90	+7.09	4.50

period in early August but was terminated by a return to dry conditions.

DISCUSSION

Study of published reports of previous snout migrations and contemporary weather systemics reveals that climatic conditions of cen-

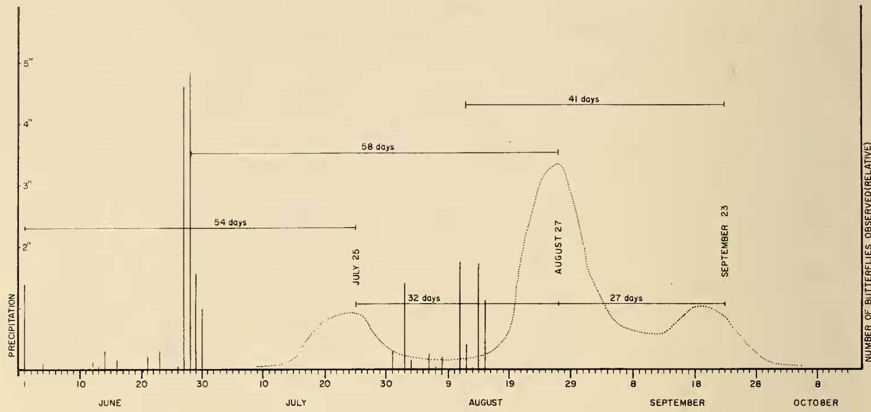

FIG. 2. Time relationship between rainfall at Eagle Pass and snout butterfly migration at Austin. Abscissa = relative butterfly numbers; Ordinate = calendar.

tral and south Texas are the key to snout butterfly migrations (Neck, unpubl.). The initial low-density migration in late July (not observed by Helfert) probably involved adults from south Texas which developed subsequent to the initial rains in the Border Country. Upon migrating to central Texas (under drought conditions) flights of these first generation butterflies were not joined by central Texas snout butterflies (which occurred in very low numbers at that time). Additionally, stimuli which evoke massive synchronized migration were lacking; adults moved more or less individually. Eggs were laid by these south Texas butterflies on central Texas *Celtis*; larvae from these eggs faced conditions favoring rapid population growth (abundant new plant growth and depressed populations of natural control agents). Adults of this second generation formed the massive migrations seen in late August in Austin (note mature larvae found in mid-August at Austin). The smaller-scale migration seen in mid-September apparently involved adults of a third generation. The reason for its smaller size was probably two-fold: 1) reduced amount of new plant growth; and 2) increased population levels of natural control agents.

Helfert (1972) suggests that central Texas is a major breeding ground of *larvata*. Breeding occurred in moderate numbers in 1971 in central Texas, but such conditions are unusual. Normally, *larvata* occurs at low population levels in central Texas. The largest breeding ground for this species is south Texas and adjacent parts of northeastern Mexico where its favored larval foodplant (Kendall and Glick, 1972), spiny hackberry (*Celtis pallida* Ten.), is very abundant. Dorothy Yeager (pers. comm., 20 Feb. 1976) reported that during September and October hackberry trees within a 4-km radius of Pearsall, Frio County, were "almost completely denuded of leaves." This observation also indicates that the Border Country area is the breeding grounds for a great number of the snout butterflies of this migration.

Occurrence of associated major and minor migrations of the snout butterfly has apparently not been reported previously. Temporal separation of occurrence of drought-breaking rains in south and central Texas may have caused the occurrence of these major and minor migrations. Normally, such drought-breaking rains occur in these areas concurrently. The temporal relationship between the drought-breaking rains and the snout butterfly migrations is shown in Fig. 2.

QUESTIONS RAISED

A series of questions has been raised by analysis of this snout butterfly migration. Tentative answers are here given to these questions. Study of future migrations will shed light on the validity of these answers.

1) Would the late July (first minor) migration have been a larger migration if rains had occurred in central Texas in late June?

Not likely; two generations of favorable breeding conditions are probably required to produce such a tremendous build-up of numbers of individuals. The central Texas area was not the source of these butterflies except for a contribution of unknown importance to the late August (major) migration.

2) Would the migration of late August (major) have occurred if rains had not returned to the Border Country area in late July and early August?

Yes, although possibly on a smaller scale; these butterflies originated as the second generation from the Border Country of Texas and Mexico as a result of the June rains. Rainfall in late July in the Border Country was relatively minor. One possible result of the absence of these later rains would have been the diminution of this major migration.

3) Would the late September (second minor) migration have been a major migration if rain had continued through September?

Probably not; by this time natural control agents had presumably increased in population size sufficiently to have a dampening effect upon population levels of the snout butterfly. One should also consider the possibility that many of these butterflies may have originated in central Texas.

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LITERATURE CITED

BEASOM, S. L. & R. A. MOORE. 1977. Bobcat food habit response to a change in prey abundance. Southwestern Nat. 21:451–454.

CLARK, D. R., JR. 1974. The western ribbon snake (*Thamnophis proximus*): ecology of a Texas population. Herpetologica 30:372–379.

——— 1976. Ecological observations on a Texas population of six-lined racerunners, *Cnemidophorus sexlineatus* (Reptilia, Lacertilia, Teiidae). J. Herpetology 10:133–138.

CLARK, D. R., JR. & R. R. FLEET. 1976. The rough earth snake (*Virginia striatula*): ecology of a Texas population. Southwestern Naturalist 20:467–478.

CLENCH, H. K. 1965. A migration of *Libytheana* and *Kricogonia* in southern Texas. J. Lepid. Soc. 19:223–224.

FERRIS, C. D. 1976. The butterflies of North America (book review) J. Lepid. Soc. 30:138–143.

FLETCHER, R. K. 1926. Notes on a migration of the snout butterfly (Lepid., Libytheidae). Entomol. News 37:106–107.

GABLE, C. H. & W. A. BAKER. 1922. Notes on a migration of *Libytheana bachmanii* Kirtl. Can. Entomol. 54:265–266.

HELFERT, M. R. 1972. Migratory behavior of the snout butterfly, *Libytheana bachmanii larvata* (Strecker). Entomol. News 83:49–52.

HOWE, W. H. 1972. Family Libytheidae. The snout butterflies. Pp. 257–258, *in* W. H. Howe (coord. ed. and illus.). The Butterflies of North America. Doubleday & Co., Garden City, New York.

KENDALL, R. O. & P. A. GLICK. 1972. Rhapalocera collected at night in Texas. J. Res. Lepid. 10:273–283.

KENDALL, R. O. & C. A. KENDALL. 1971. Lepidoptera in the unpublished field notes of Howard George Lacey, naturalist (1856–1929). J. Lepid. Soc. 25:29–44.

MARTIN, R. F. 1977. Variation in reproductive productivity of range margin tree lizards (*Urosaurus ornatus*). Copeia 1977:83–92.

NECK, R. W. 1976. Lepidopteran foodplant records from Texas. J. Res. Lepid. 15:75–82.

PARMAN, D. C. 1926. Migrations of the long-beaked butterfly, *Libythea bachmanii* Kirtland (Lepid.: Libytheidae). Entomol. News 37:101–106.

WEBSTER, F. S., JR. 1972. Fall migration 1971. South Texas Region Amer. Birds 26: 84–88.